Results: The proband's baseline ECG displayed a QTc interval of 692 ms and apparently bifid T waves in nearly all leads. Direct sequencing of her DNA revealed a heterozygous mutation in the transmembrane pore region of KCNH2 consisting of a G-to-A transition at nucleotide 1825 (c.1825G>A), predicting a substitution of an asparagine for aspartate at highly-conserved residue 609 (P.Asp609Asn, D609N), which was also present in her son with a QTc interval of 465 ms and absent in her unaffected family members and 150 healthy controls. This mutation is predicted to be possibly damaging with a score of 0.688 by PolyPhen-2, and to affect protein function with a score of 0.03 by SIFT. Oral administration of verapamil (240 mg daily) shortened QTc to 541 ms, converted of T wave morphology from bifid to biphasic and abolished TdP without ICD shock delivery in the proband over a 3-year follow-up period. In vitro studies, verapamil dose-dependently shortened QT interval, decreased transmural dispersion of repolarization, and suppressed TdP in the LQT2 model. Concordant but stronger effects on the electrophysiological properties of the LQT2 model were noticed when nifedipine was perfused.
Conclusions: These results indicate a possible therapeutic role of verapamil in management of LQT2 patients.

GW25-e3149

Preexcitation syndrome:experimential study on the electrocardiogram of antegradely conducting accessory pathway

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Objectives: In preexcitation syndrome, initial vector change (delta wave) is highlighted. However, there has been little information concerning terminal QRS vector change. In our study, preexcitation was simulated in the rabbit model by applying electrophysiological technique. Then we further explored the effect of antegradely conducting accessory pathway (AP) on ECG characteristics.
Methods: Ten healthy rabbits were selected. Sensing electrode and stimulating electrode were placed to high right atrium and epicardial surface of atrioventricular groove of left ventricular anterior wall, respectively. Programmed premature stimulation S_2 synchronized P wave positively swept ventricle (step length was 5 ms). We made a comparison of sinus PR interval (ventricular activation time via normal pathway), sinus QRS complex (ventricular activation via normal pathway) and cardioventricular pacing QRS complex (ventricular activation via AP) to observe the initial, maximal and terminal QRS vector of R_2 in the process of PS_2 (ventricular activation time via AP) positive sweep. We also observed the relationships between the difference of PS_2 and PR interval and R_2 morphology change.
Results: Preexcitation was successfully simulated in the rabbit model including complete preexcitation, incomplete (typical) preexcitation, incomplete latent preexcitation and complete latent preexcitation. PS_2 interval<PR interval: when the difference was$\geq$47.00$\pm$ 7.53 ms, R_2 was complete preexcitation, inversely, R_2 was incomplete preexcitation; PS_2 interval$\geq$PR interval: when the difference was $\leq$13.00$\pm$3.50 ms, R_2 was incomplete latent preexcitation, inversely, R_2 was complete latent preexcitation.
Conclusions: The ECG characteristics of antegrade conduction of AP depends on the time difference of conduction through AP and normal pathway. According to the degree of preexcitation, ECG characteristics included complete preexcitation, incomplete (typical) preexcitation, incomplete latent preexcitation and complete latent preexcitation. The presence of a delta wave indicated that AP conduction was faster than AV node conduction. The terminal QRS vector change represented the ventricles were pre-excited through an AP. The change of terminal QRS vector was helpful for identifying the preexcitation without evident delta wave and incomplete latent preexcitation.

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Pure fascicle capture pace mapping can help to identify the target for ablation of left upper septal fascicular ventricular tachycardia

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Objectives: Left upper septal fascicular ventricular tachycardia (VT) was rare. Its mechanism was deemed as triggered activity or microreentry in the fascicular system. Radiofrequency (RF) ablation can successfully eliminate the site of origin (SOO) by identifying the earliest fascicular potential (FP).However, inability to re-induce VT after accidental mechanical termination, frequently made the procedure troublesome. Our objective is to find the criteria of pace mapping which can work as a surrogate for activation mapping when tachycardia was no longer inducible.
Methods: We included two patients (both men, aged 22 yrs and 45 yrs) with left upper septal fascicular VT. The VT QRS was relatively narrow with an incomplete right bundle branch block morphology and inferior frontal axis. Transthoracic echocardiography confirmed normal left ventricular systolic function and the absence of structural heart diseases. Mapping catheters were introduced via venous access to the coronary sinus, His bundle electrogram recording region and right ventricular apex, and via retroaortic approach to the left ventricle. Activation mapping of SOO and pace mapping (10 mA current and 2 ms pulse width at tachycardia cycle length) were guided by fluoroscopy and Carto mapping system. After the procedure, the patients were discharged on aspirin for 1 months and were followed on monthly basis using electrocardiography.
Results: In both cases, the SOO were mapped to be next to the proximal left anterior fascicle, where the main left bundle just gave rise to two fascicles. In case 1 with paroxysmal VT, H-V intervals were 50 ms during sinus rhythm (SR) and 22 ms during VT. FP-V intervals at the SOO during SR and VT were both 38 ms. Pacing at the SOO can intermittently lead to pure fascicle capture with QRS identical with that of VT. The Stimulus-V (S-V) interval was 38 ms, and H-V interval of pure fascicle capture beat was 22 ms. In case 2 with incessant VT, H-V intervals were 48 ms during SR and 8 ms during VT. FP-V intervals at the SOO during SR and VT were both 30 ms. Pure fascicle capture at the SOO had an S-V interval of 30 ms and an H-V interval of 8 ms, which also produced perfectly matched QRS morphology. In both cases, pure His-purkinje system capture pace mapping at sites other than SOO can at best either produce identical QRS or identical H-V interval, but never met both criteria. RF applied at the SOO (power-controlled, 15 watts with titration up to 25 watts) eliminated the VTs. Both patients developed left anterior hemiblock after procedure. Both patients remained well during follow-up period of 6 months and 2 months respectively.
Conclusions: During pure fascicle capture pace mapping, identical QRS morphology and identical H-V interval with those of VT should be simultaneous achieved to identified the SOO of left upper septal fascicular VT. Perfect pure fascicle capture pace map can serve as the surrogate target when VT is no longer inducible during activation mapping.

GW25-e2176

Developing Integrated Echocardiographic Protocol to Optimize Cardiac Resynchronization Therapy with Quadripolar Lead

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Objectives: Inappropriate lead position is one of major reasons for nonresponse to cardiac resynchronization therapy (CRT). CRT with quadripolar lead offer programming flexibility with 4 electrodes and up to 10 pacing configurations, which result in greater CRT efficiency. However, how to choose and validate the suitable configuration to maximally reduce myocardial dyssynchrony and improve cardiac hemodynamics/output remains a challenge. We investigated a variety of echocardiographic optimization protocols, aiming to identify the best echocardiographic parameters, and define their roles in improving the accuracy and efficacy of current on-line and off-line optimization protocols for CRT with quadripolar lead.
Methods: We studied 22 patients (65.6$\pm$16.5 years old) who were implanted CRT in the Upstate Medical University Hospital of State University of New York.. Nine of them had CRT with quadripolar lead, and 13 of them with conventional bipolar leads. All patients were assessed by tissue Doppler (TDI) based tissue synchronization imaging (TSI), two dimensional (2D) and four dimensional (4D) strain analysis immediately after implantation. In patients receiving CRT with quadripolar lead, we tested pacing thresholds of each configuration. The speckle tracking analysis was performed with both 2D and 4D strain protocols. We used 4D strain to track myocardial contractility from frame to frame in three dimensional (3D) over time, obtained the real-time strain patterns during both diastolic and systolic cycle, and established the "real" myocardial deformation curves through the entire cardiac cycle.
Results: The major parameters improved after echo optimization were left ventricular (LV) ejection fraction (24.2%$\pm$10.3% vs 32.8%$\pm$9.4%, P=0.019), mean NYHA class (3.2$\pm$0.5 vs 2.2$\pm$0.6, P=0.000), and QRS duration (162.0$\pm$25.9 ms vs 139.2$\pm$14.0 ms, P=0.013). Radial strain analysis with 4D protocol demonstrated reproducible results during optimization analysis. Among 4D strain analysis, longitudinal and circumferential strain abnormalities always preceded the radial strain abnormalities. The area strain (combined the effect of both longitudinal and circumferential strain) correlated well with the results from radial strain analysis. 4D strain protocol measures all of the 3 strain components in all LV segments from a single acquisition, to decide the best pacing configuration out of 10, which made the optimization of CRT with quadripolar lead more quickly and accurately than TDI or 2D strain protocols. 4D strain analysis was also less affected by the change in volume status/cardiac preload and heart rate.
Conclusions: Area strain measurement in 4D strain protocol increases the diagnostic value to detect regional myocardial mechanic dyssynchrony during the echocardiographic optimization. The full-volume data sets by 3D reconstruction acquires data more efficiently, and helps 4D strain analysis to become a bedside valuable tool for optimization of CRT with quadripolar lead.

GW25-e2218

Correlation Analysis of Echocardiographic Parameters and Atrial Fibrillation Thromboembolism Risk Scoring

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Objectives: Thromboembolism risk assessment system of Atrial fibrillation (AF) is all clinical indicators in clinical, and some indicators are subjective, this study assumes that echocardiography can identify the patients with atrial fibrillation at high-risk of